
TOP-RELATED BENCHMARKS



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Joint between BSM and Top subgroups

- this talk: flavor of ongoing/planned studies
- more details on webpages:
<http://www.snowmass2013.org/tiki-index.php?page=Fully+Understanding+the+Top+Quark>
<http://www.snowmass2013.org/tiki-index.php?page=The+Path+Beyond+the+Standard+Model>
- ...and talks to follow...

STOPS

(simplified models)

SUSY in a nutshell

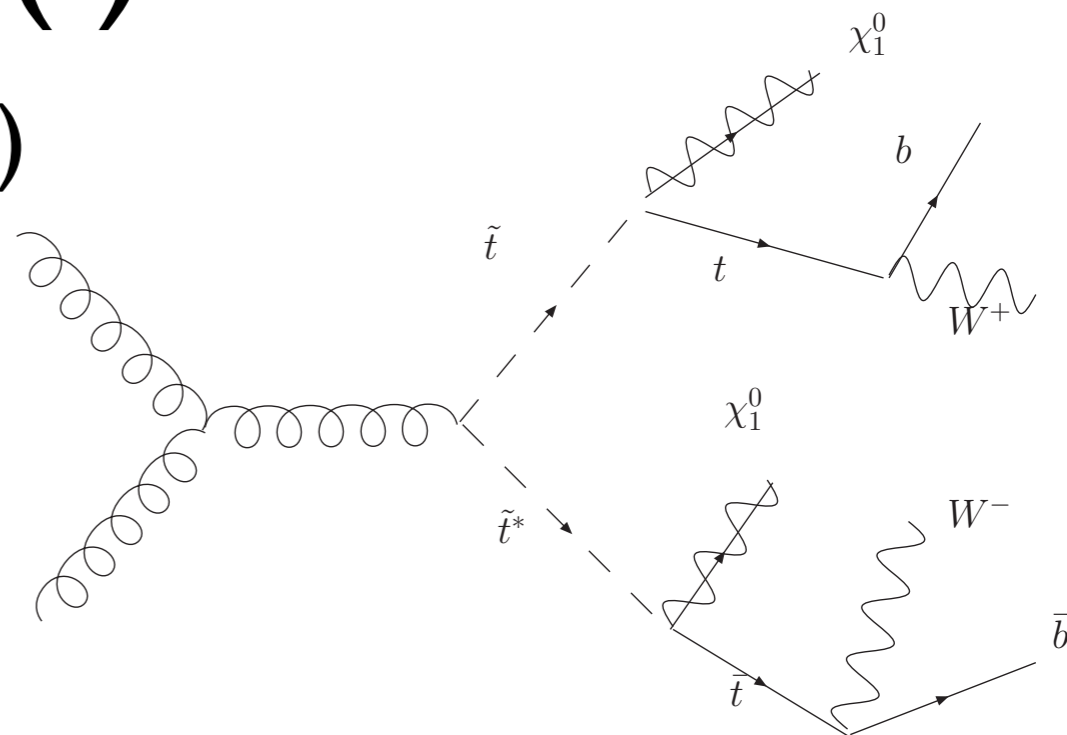
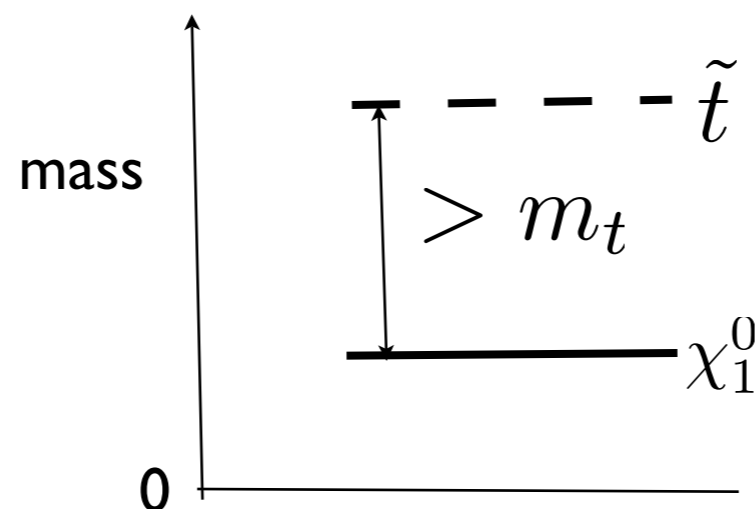
The diagram shows the cancellation of two Feynman diagrams for the higgs self-energy. On the left, a solid circle loop with an arrow indicates a top quark (t) loop. It is connected to two horizontal dashed lines representing higgs bosons (h). In the middle is a minus sign. On the right, a dashed circle loop with an arrow indicates a stop squark (\tilde{t}) loop, also connected to two horizontal dashed lines representing higgs bosons (h). To the right of this is an equals sign followed by a zero with an exclamation mark ($= 0!$).

- “Light” stops for naturalness
- R-parity conserved (LSP stable, invisible) or violated

RPC stops (I)

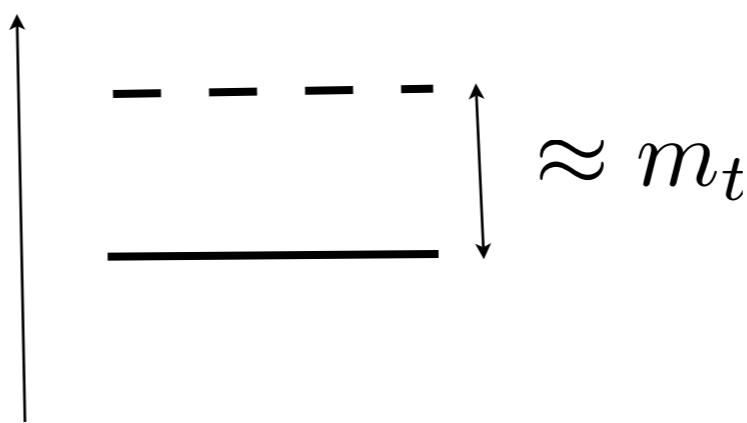
- Basic process (SM top is background)

- Vanilla spectrum

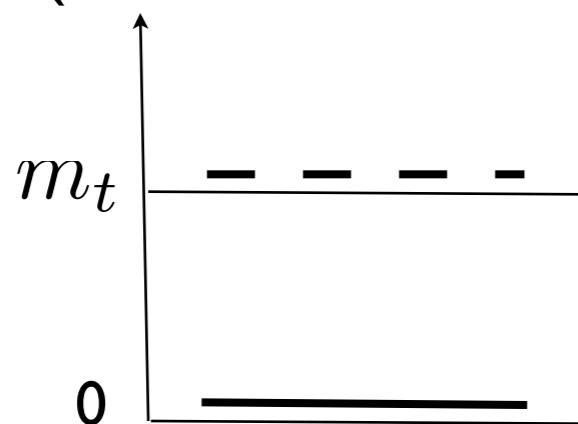


- Compressed (MET small)

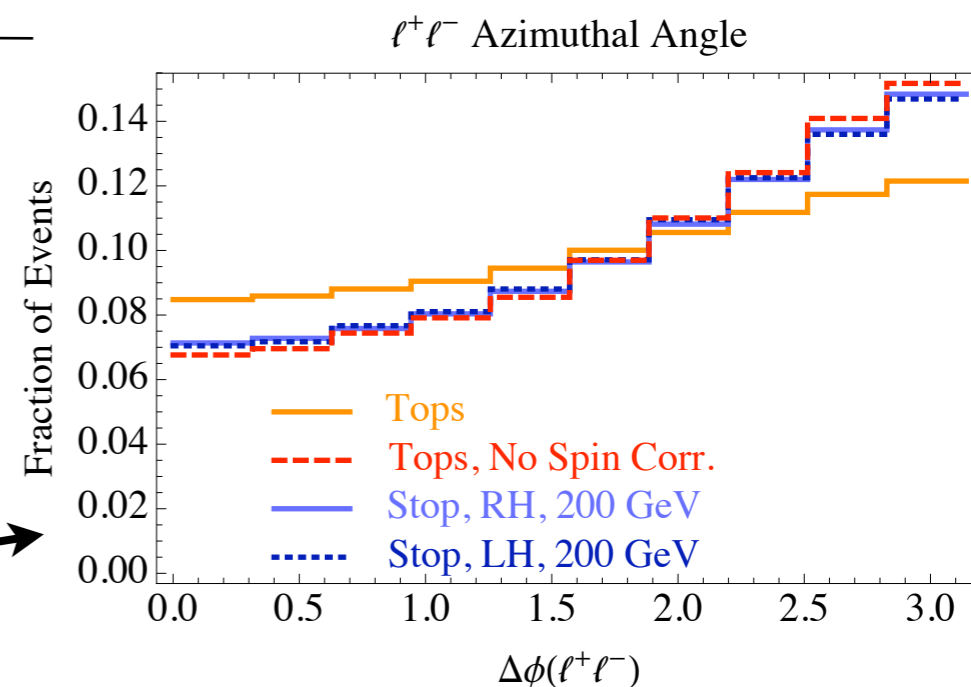
(D.Walker's talk in
Thurs. 2 pm. session)



- stealth (MET small even with ISR)

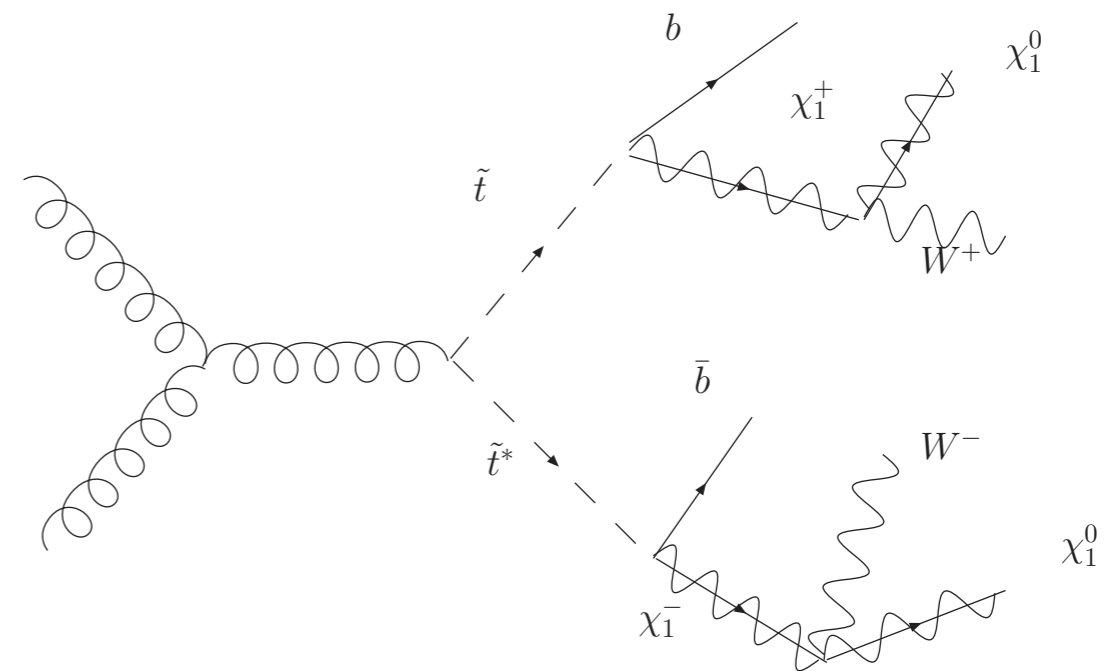
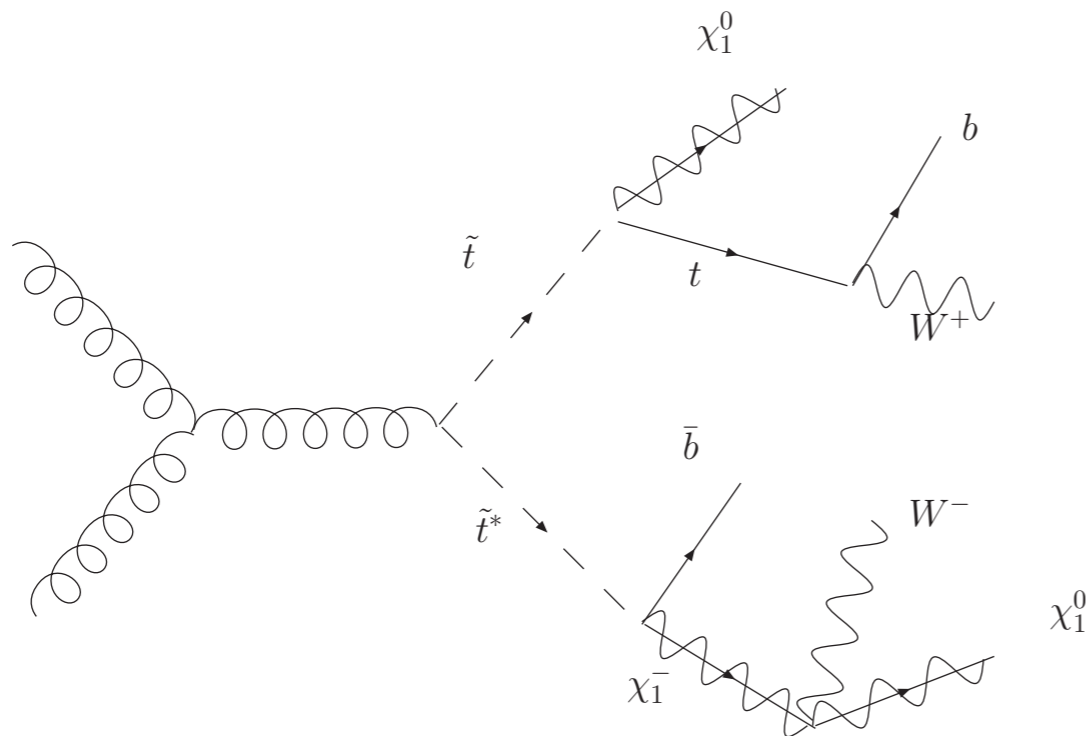
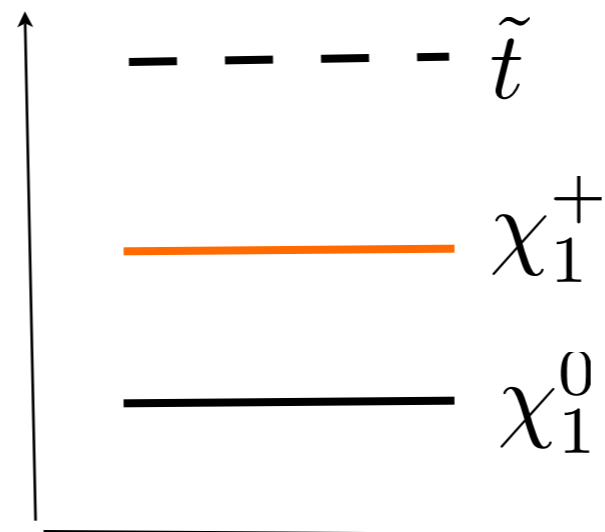


use spin-correlations
(Han, Katz,
Krohn,Reece:
1205.5808)



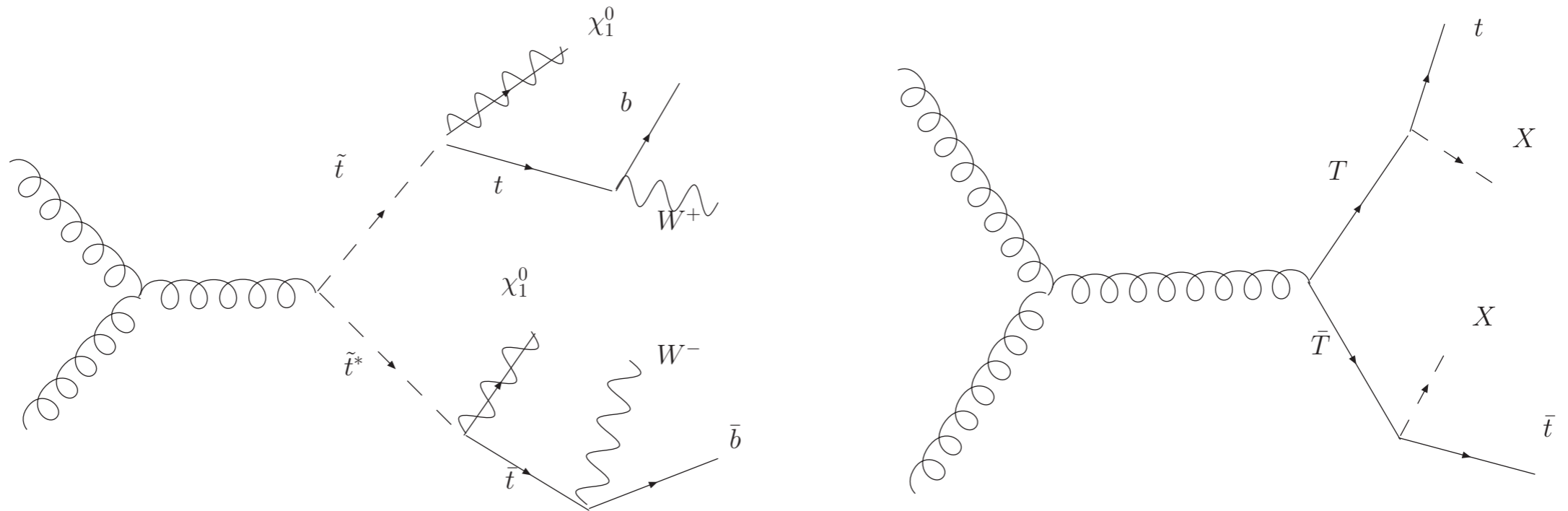
RPC stops (II)

- another “layer”



- asymmetric (M. Graesser) or symmetric (Y. Bai):
talks in Thurs. 2 pm. session

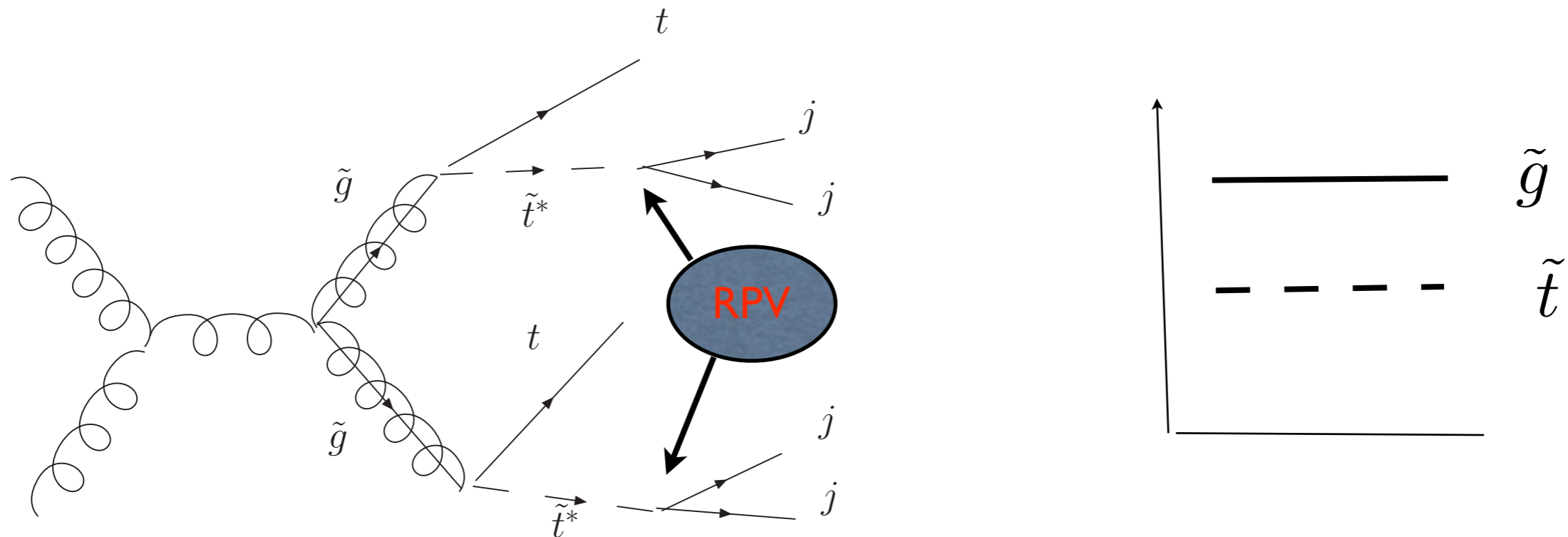
Aside: distinguishing spin



- SUSY vs. little Higgs with T-parity...

(see summary on top webpage)

RPV stops (no MET)

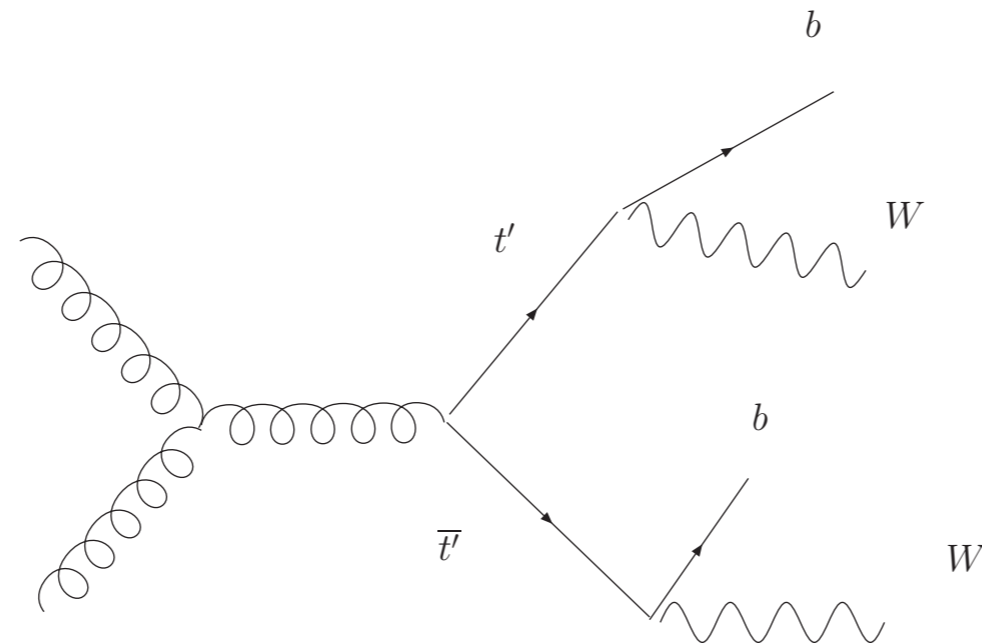


- A. Katz's talk in Fri. 2 pm. session (fully reconstruct in semileptonic channel for top pair)

Heavy top/bottom-like
fermions

(simplified models)

Chiral (4th generation)



- constrained by EW precision tests; Higgs data...

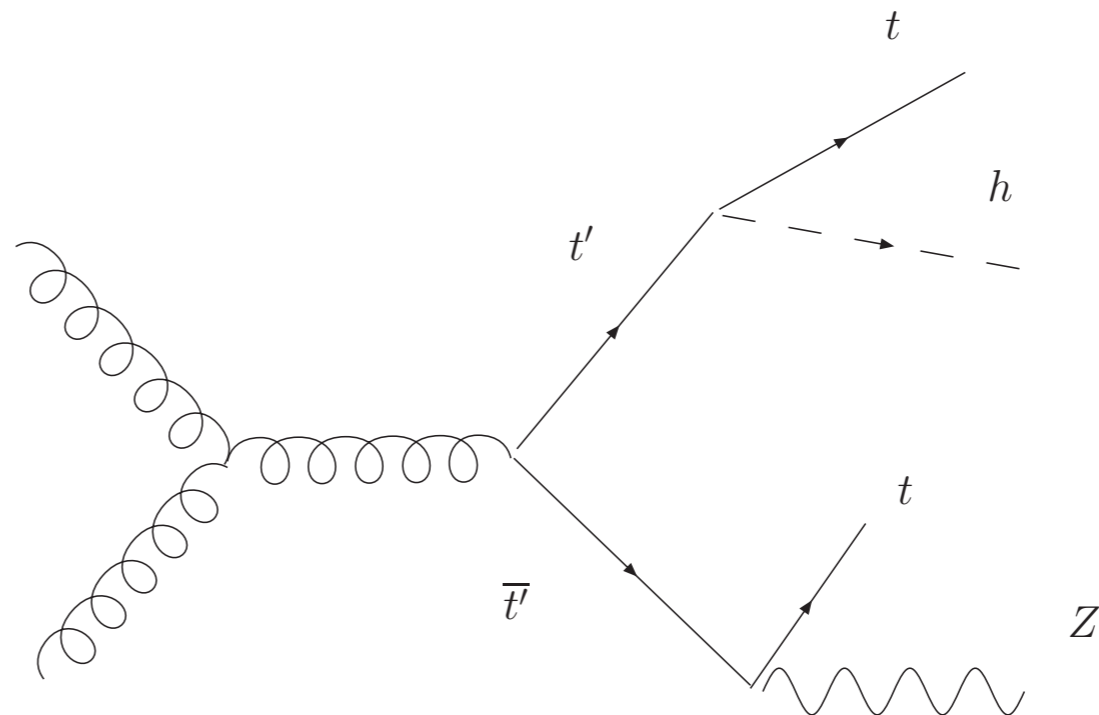
Vector-like (top-partners)

- alternate cancellation of Higgs mass divergence

The diagram shows the cancellation of Higgs mass divergences. On the left, a Higgs boson line (dashed line with an arrow labeled h) enters a loop of top quarks (solid line with an arrow labeled t). On the right, a Higgs boson line (dashed line with an arrow labeled h) enters a loop of top-partners (solid line with an arrow labeled t'). The two diagrams are subtracted, resulting in zero: $= 0!$

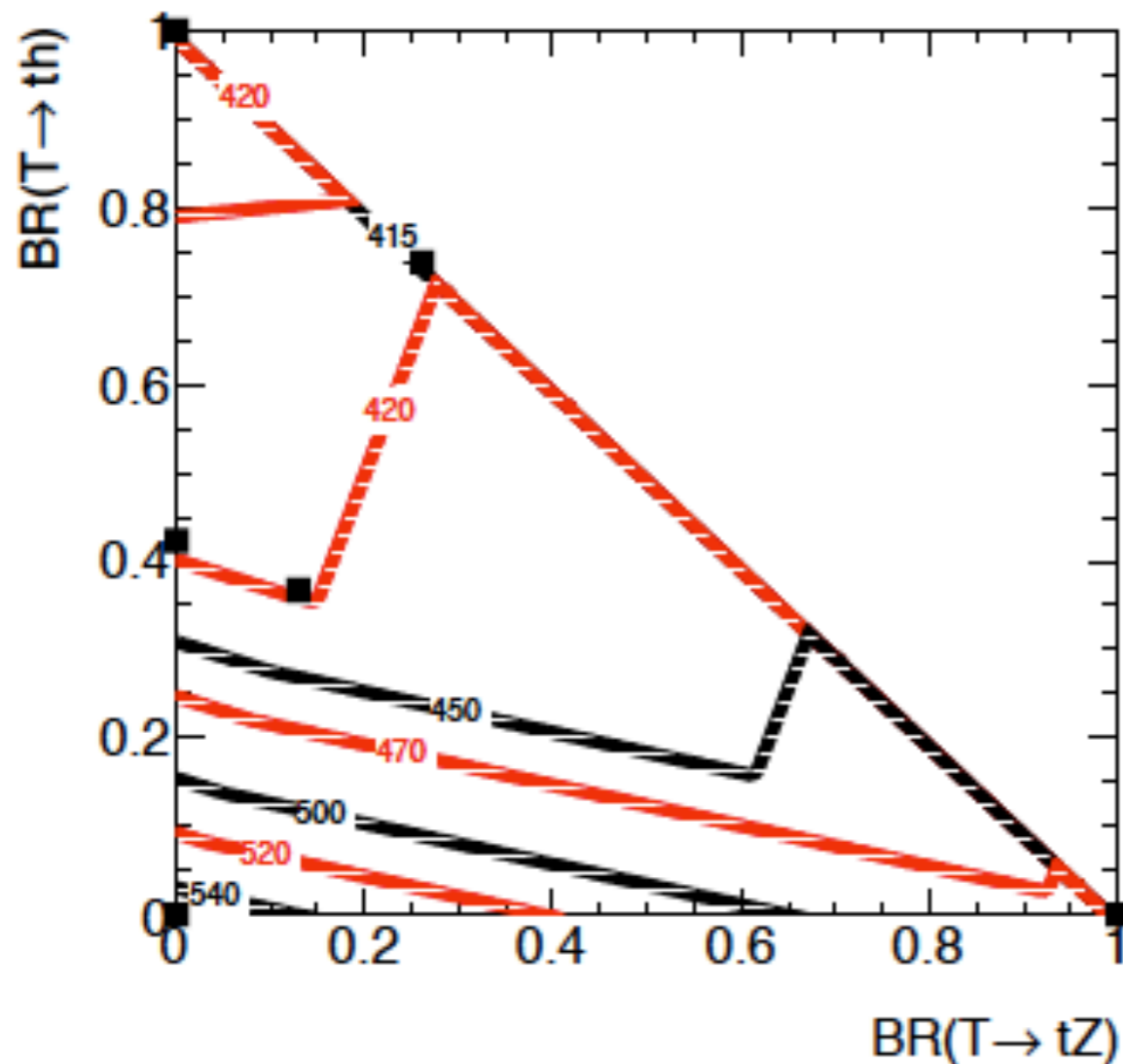
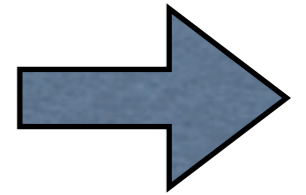
- safer from EW precision tests
- additional decays

(talk by K. Black in
Thurs. 2 pm. session)



“Triangles”...

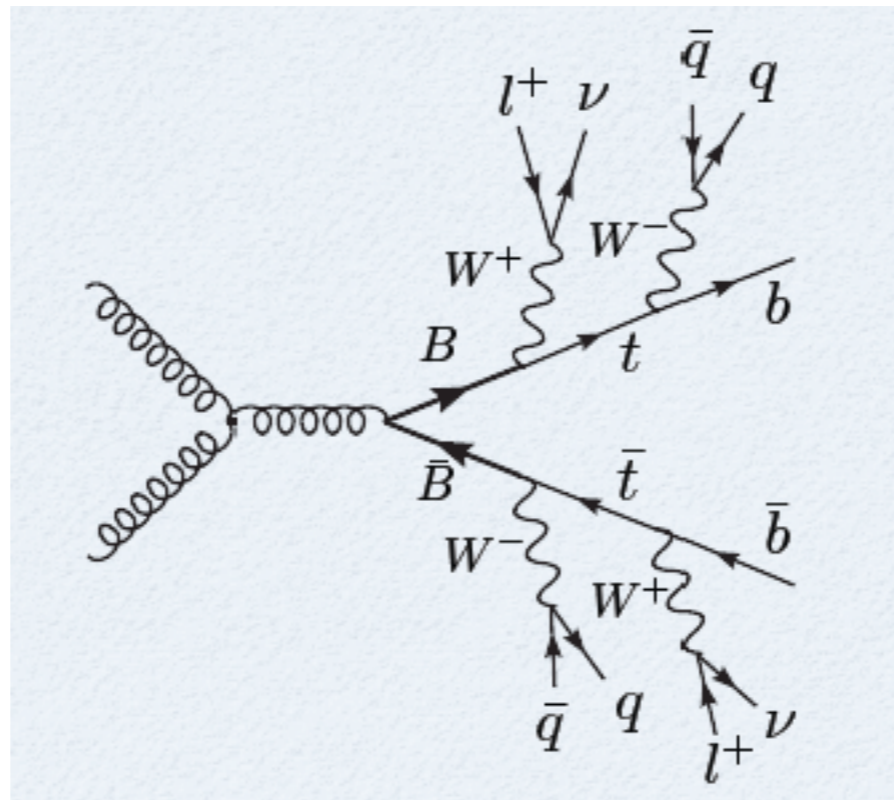
- Look for all 3 channels: equivalence theorem
BR's ratio is 2:1:1



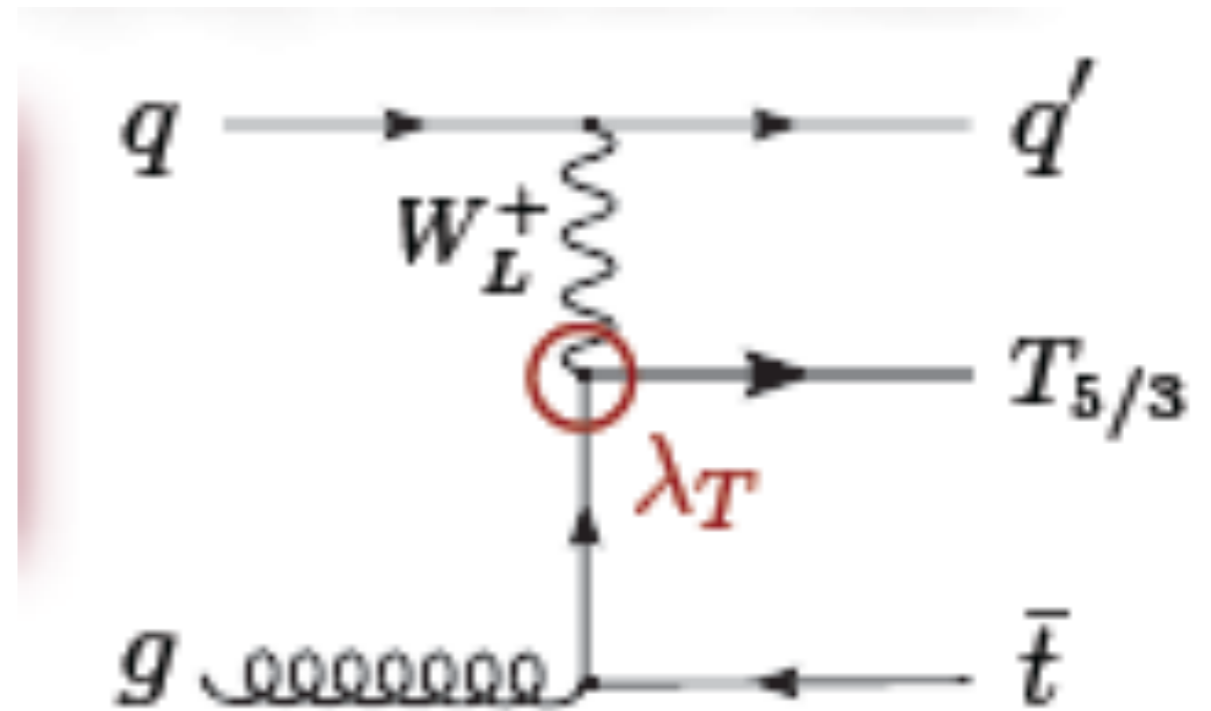
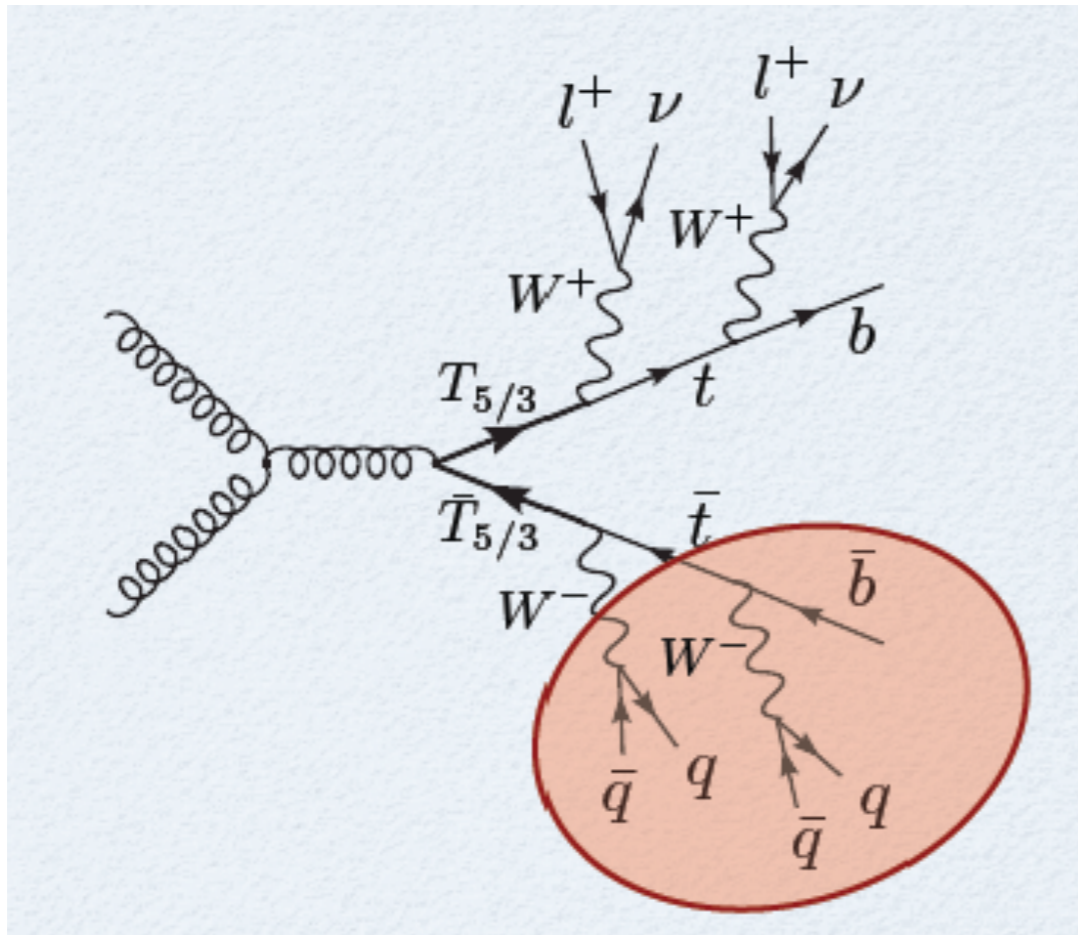
Rao, Whiteson (1204.4504)

Vector-like bottom partners

- Top-like final states...



Exotic-charge fermions



- motivated in composite Higgs
- Same-sign dileptons
- Single or pair production

(Talk by A. Avetisyan in Thurs. 2 pm. session)

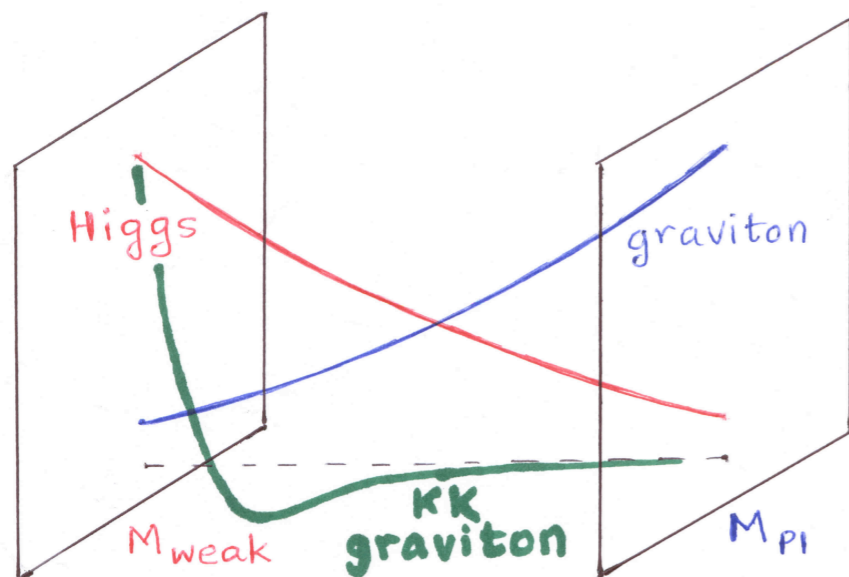
Top-pair resonances
(see also C. Pollard's talk in Thurs. 2
pm. session)

A **complete** model of top-pair resonances: Warped extra dimension

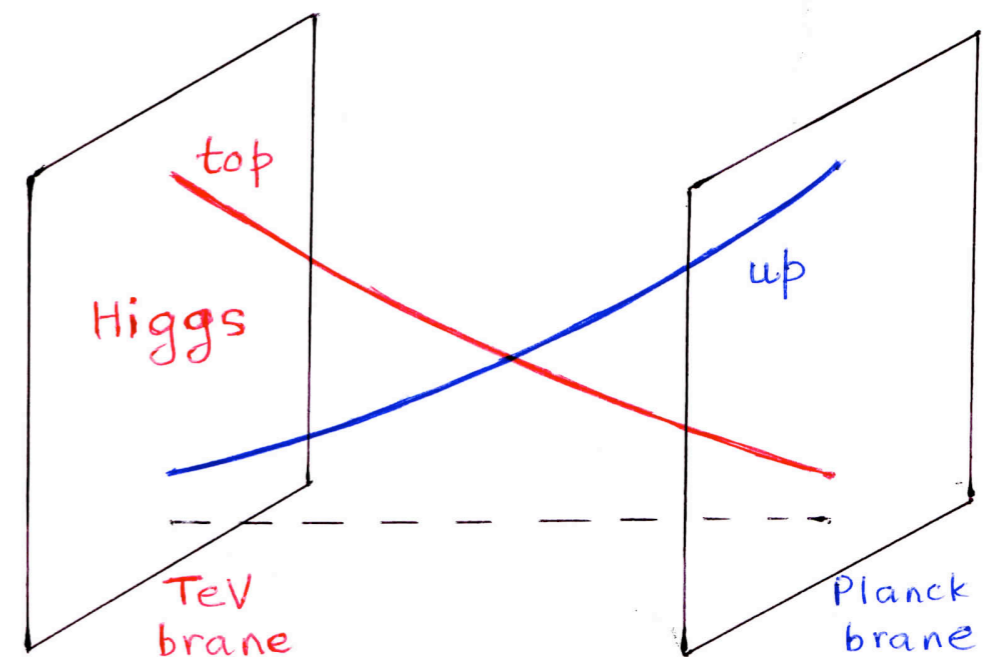
(overview here: see also talk by M. Bauer
in Thurs. 2 pm. **flavor**, NP session)

A tale of **two** geometrical hierarchies

Planck-weak

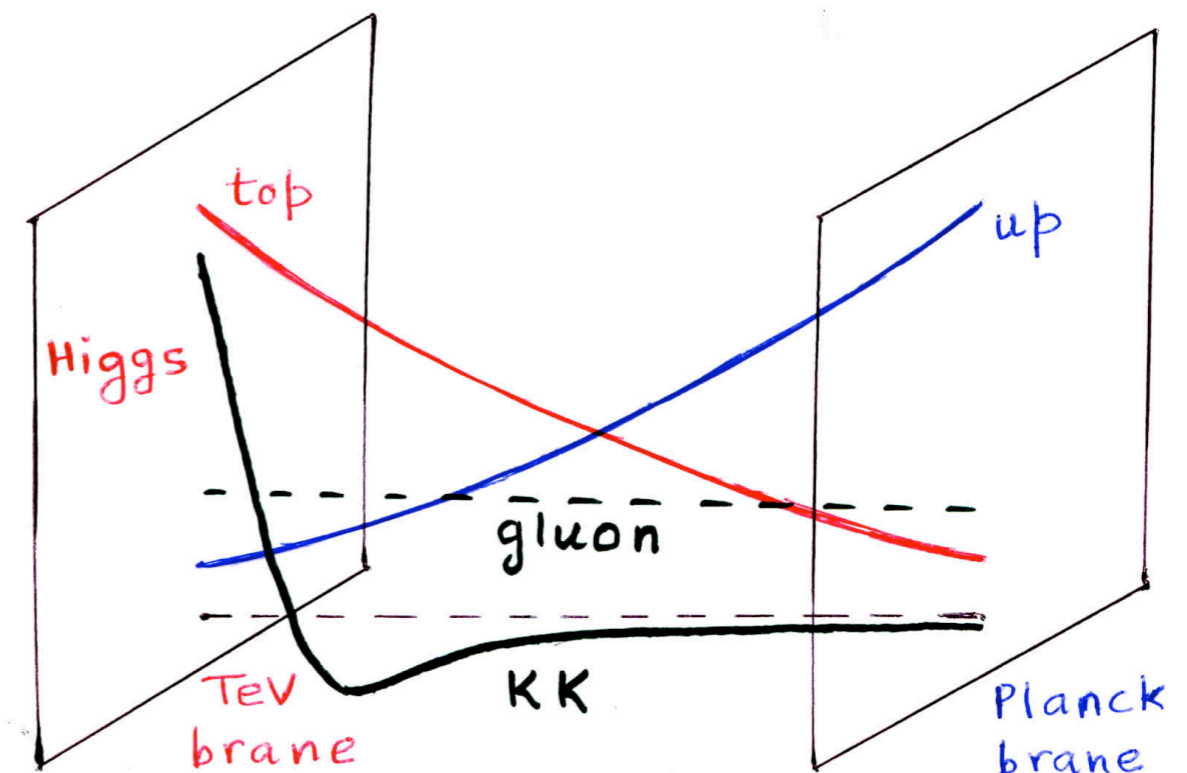


Flavor



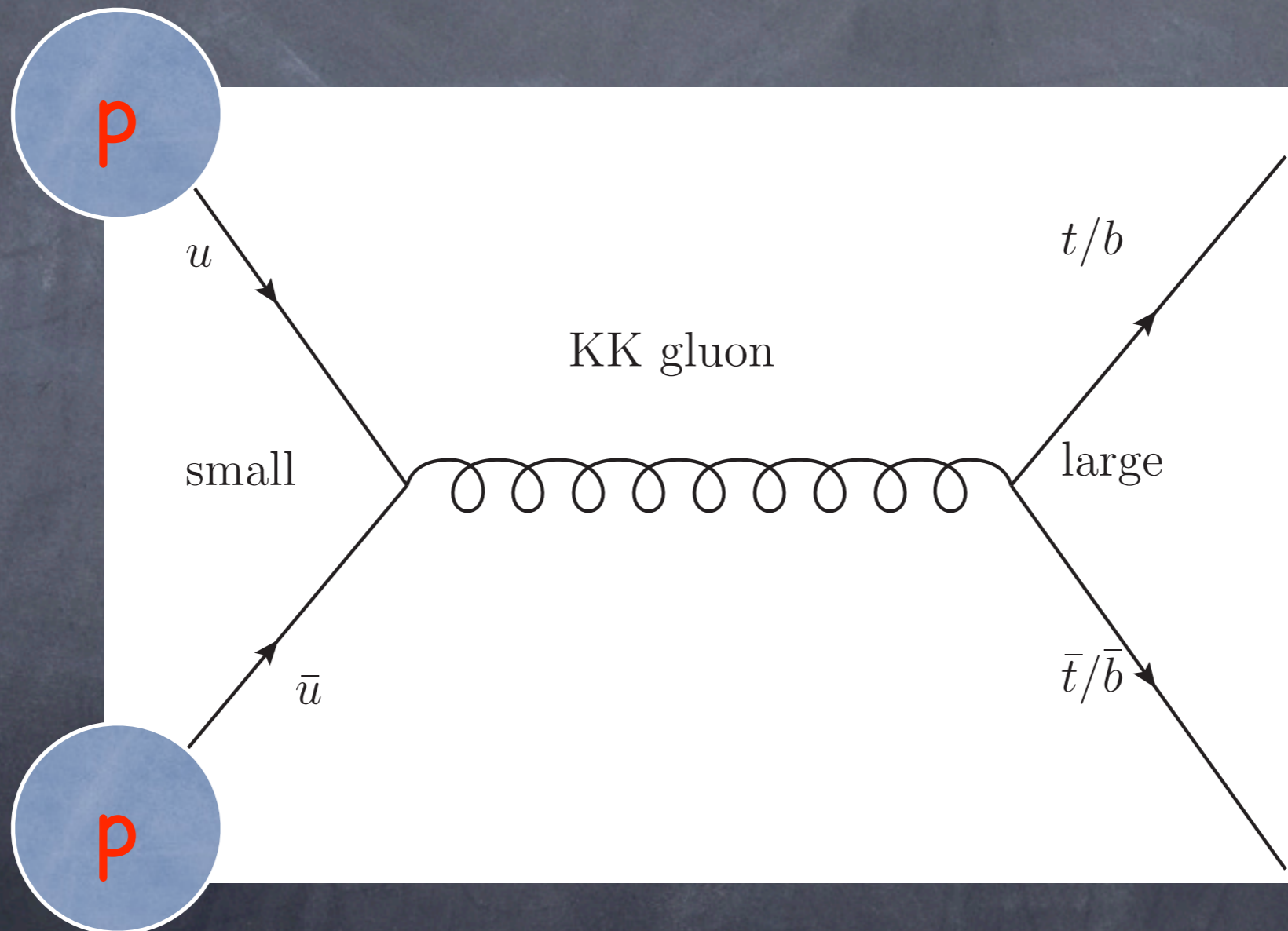
(Geometry-based) Phenomenology

- KK gluon, Z, W, graviton couple dominantly to top/bottom (+ h, longitudinal W/Z...not to light quarks/leptons/photon)
- KK mass a few TeV (precision tests)



→ look for **boosted** tops

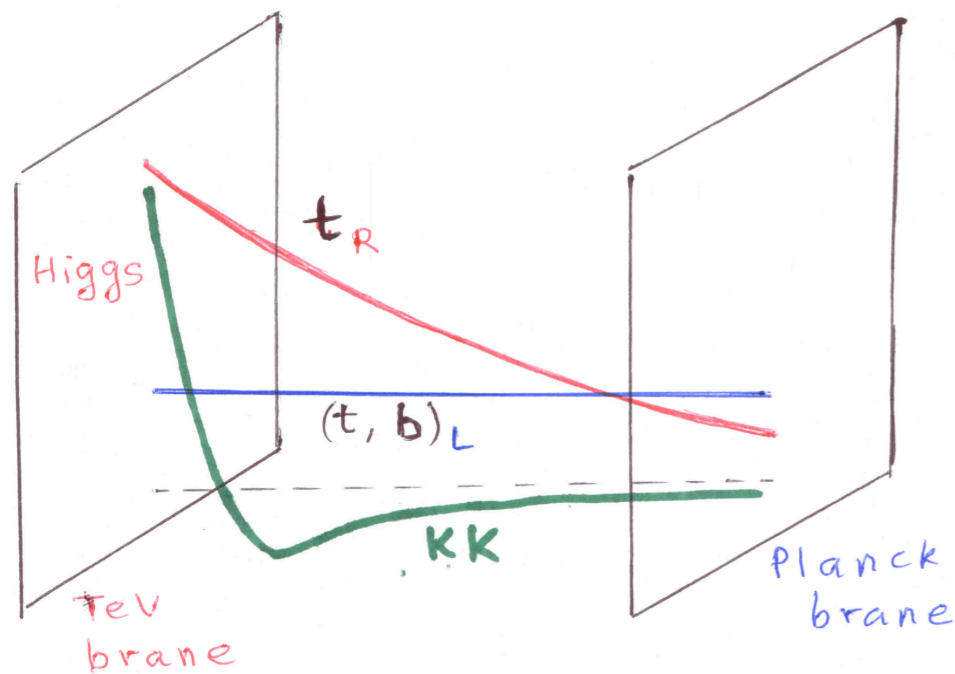
(talk by J. Dolen and J. Pilot in Fri. 9 am. session)



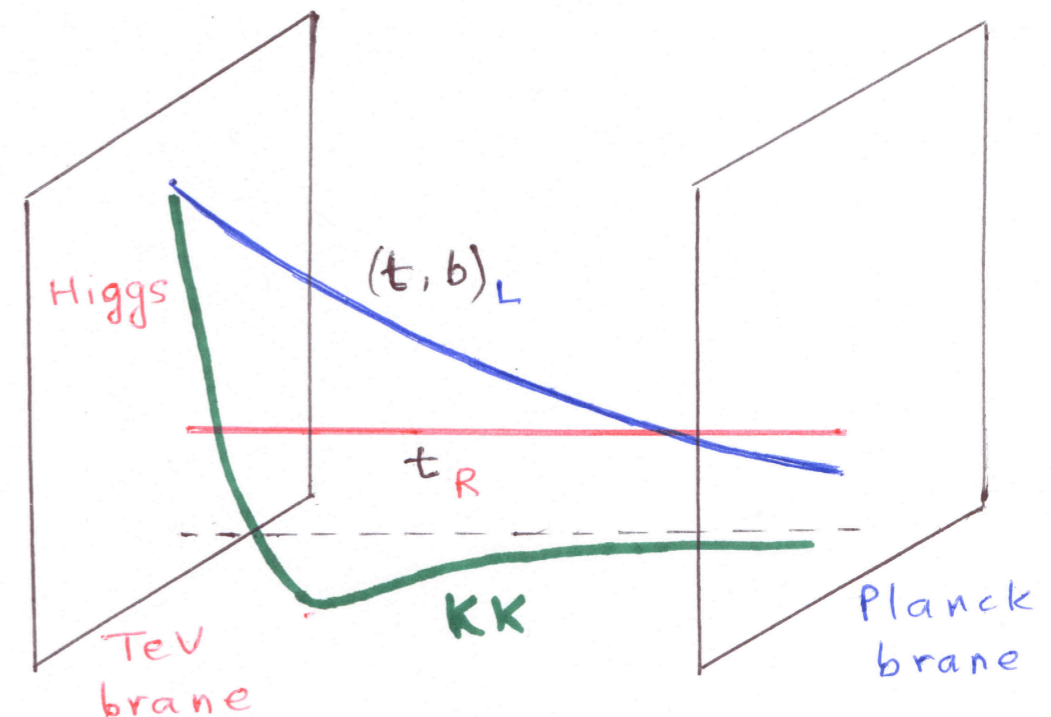
• ...and boosted h , W , Z ...

2 benchmarks: different polarization of tops + ...

no KK $W \rightarrow tb$

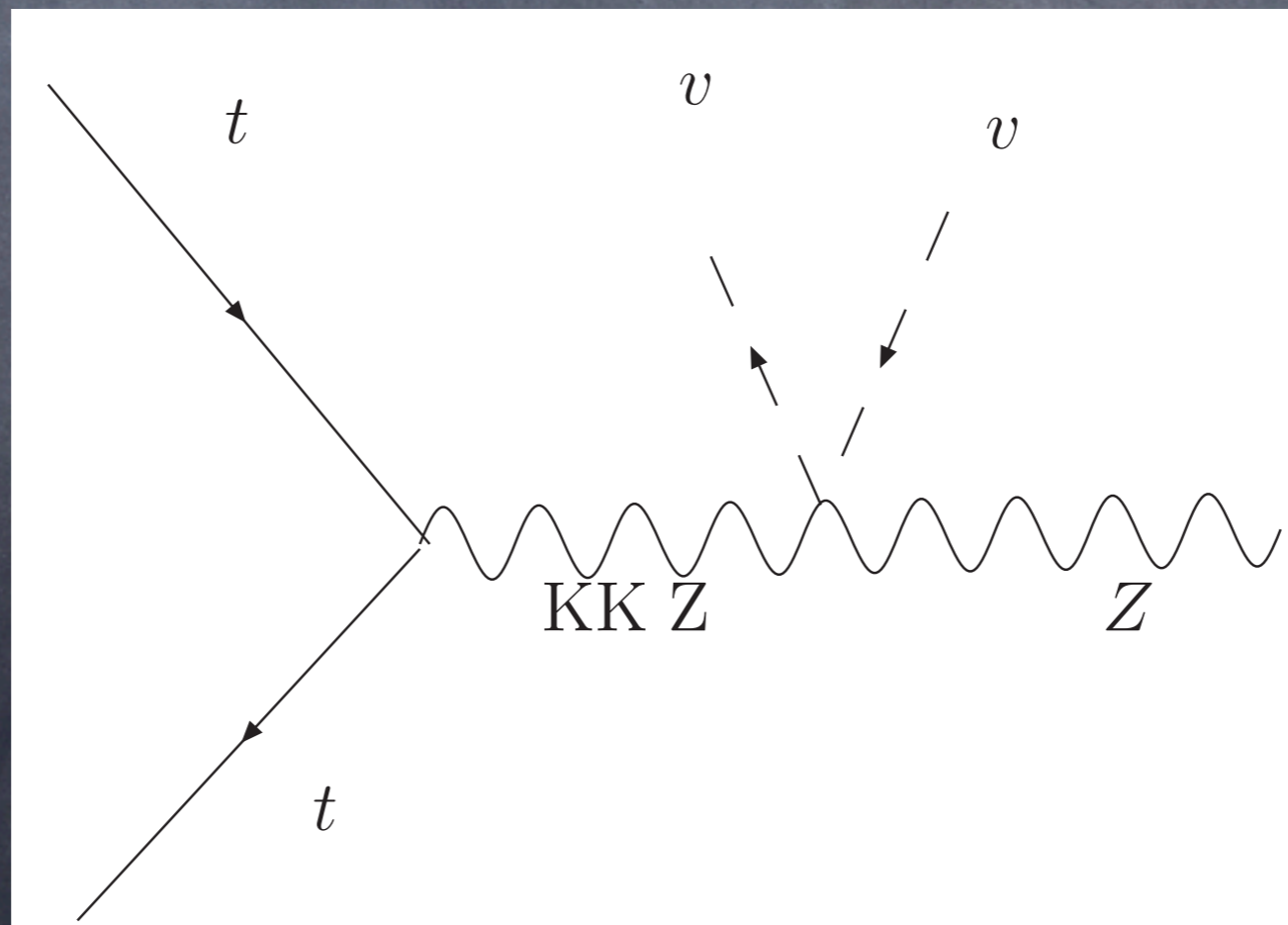


bottom in game...



Other warped phenomenology

- KK top (a.k.a. “top-partners”)
- indirect effect of KK's: shift in top couplings to Z , h ...





JOIN THE FUN!